

WHAT IS CLAIMED IS:

1. An easy-to-straight-tear thermoplastic resin film having substantially parallel linear scratches formed on at least one surface, whereby it is easily torn substantially straight from any point along said linear scratches.
2. The easy-to-straight-tear thermoplastic resin film according to claim 1, wherein the depth of said linear scratches is 1 to 40% of the thickness of said film.
3. The easy-to-straight-tear thermoplastic resin film according to claim 10 1 or 2, wherein the depth of said linear scratches is 0.1 to 10 μm .
4. The easy-to-straight-tear thermoplastic resin film according to any one of claims 1 to 3, wherein the width of said linear scratches is 0.1 to 10 μm .
5. The easy-to-straight-tear thermoplastic resin film according to any 15 one of claims 1 to 4, wherein intervals of said linear scratches are 10 to 200 μm .
6. The easy-to-straight-tear thermoplastic resin film according to any one of claims 1 to 5, uniformly having a lot of fine penetrating and/or non-penetrating pores.
- 20 7. The easy-to-straight-tear thermoplastic resin film according to any one of claims 1 to 6, wherein it is a single-layer film or a laminate film.
8. The easy-to-straight-tear thermoplastic resin film according to claim 7, wherein said laminate film comprises at least one film layer having said linear scratches, and a sealant film layer.
- 25 9. A method for forming substantially parallel linear scratches on a thermoplastic resin film, comprising bringing said film into sliding contact with a means having a lot of fine projections for forming linear scratches, and pressing said film onto said linear-scratch-forming means from the

opposite side of said linear-scratch-forming means by a film-pressing means, in a region in which said film is in sliding contact with said linear-scratch-forming means.

10. The method for producing an easy-to-straight-tear thermoplastic

5 resin film according to claim 9, wherein a roll or plate having a lot of hard fine particles on its surface is used as said linear-scratch-forming means.

11. The method for producing an easy-to-straight-tear thermoplastic resin film according to claim 10, wherein said fine particles have a Mohs' hardness of 5 or more.

10 12. The method for producing an easy-to-straight-tear thermoplastic resin film according to claim 11, wherein said fine particles are fine diamond particles.

13. The method for producing an easy-to-straight-tear thermoplastic resin film according to any one of claims 9 to 12, wherein said

15 film-pressing means is an air-blowing means.

14. The method for producing an easy-to-straight-tear thermoplastic resin film according to claim 13, wherein the pressure of an airflow blown onto said film is 0.05 to 5 kgf/cm².

15. The method for producing an easy-to-straight-tear thermoplastic

20 resin film according to claim 13 or 14, wherein air is blown from a blower or a nozzle.

16. The method for producing an easy-to-straight-tear thermoplastic resin film according to any one of claims 9 to 12, wherein said

film-pressing means is a brush brought into sliding contact with said film.

25 17. The method for producing an easy-to-straight-tear thermoplastic resin film according to claim 16, wherein said brush have hairs having a recovery-from-bending ratio of 70% or more, a diameter of 0.1 to 1.8 mm and a length of 1 to 8 cm, and a density of 100 to 500/cm² on the

brush-sliding surface.

18. The method for producing an easy-to-straight-tear thermoplastic resin film according to claim 16 or 17, wherein said brush is in sliding contact with said film at a pressure of 0.01 to 5 kg/cm² on said

5 brush-sliding surface.

19. The method for producing an easy-to-straight-tear thermoplastic resin film according to any one of claims 10 to 18, wherein said roll has an outer diameter of 2 to 20 cm.

20. The method for producing an easy-to-straight-tear thermoplastic

10 resin film according to any one of claims 9 to 19, wherein a tension of 0.01 to 5 kgf/cm width is applied to said film in sliding contact with said linear-scratch-forming means.

21. The method for producing an easy-to-straight-tear thermoplastic resin film according to any one of claims 9 to 20, wherein the moving

15 speed of said film is 10 to 500 m/minute.

22. The method for producing an easy-to-straight-tear thermoplastic resin film according to any one of claims 10 to 21, wherein linear scratches are formed in the moving direction of said film with the position of said rolls or plates fixed in the width direction of said film.

20 23. The method for producing an easy-to-straight-tear thermoplastic resin film according to claim 22, wherein the rotation axis of said roll is parallel with the width direction of said film, and wherein said roll has a lower peripheral speed than the moving speed of said film and an opposite rotation direction to the moving direction of said film.

25 24. The method for producing an easy-to-straight-tear thermoplastic resin film according to claim 23, wherein the peripheral speed of said roll is 1 to 50 m/minute.

25. The method for producing an easy-to-straight-tear thermoplastic

resin film according to any one of claims 10 to 21, wherein an endless pattern belt comprising small rolls or plates having a large number of hard fine particles on the surfaces in parallel, which is longer than the width of the film, is arranged in the width direction of said film, such that each small

5 roll or plate can be in sliding contact with said film; and wherein said endless pattern belt is rotated to continuously bring said small rolls or plates into sliding contact with said film, whereby said linear scratches are formed on said film slantingly to its moving direction.

26. The method for producing an easy-to-straight-tear thermoplastic
10 resin film according to claim 25, wherein said film-pressing means is an endless brush comprising a large number of hairs on an endless belt, which is longer than the width of the film; wherein said endless brush is disposed in parallel with said endless pattern belt via said film; and wherein said
15 endless brush is rotated to continuously bring said hairs into sliding contact with said film, such that the direction of said hairs slidably moving on said film is opposite to the direction of said small rolls or plates slidably moving on said film.

27. The method for producing an easy-to-straight-tear thermoplastic resin film according to any one of claims 10 to 21, wherein at least two
20 rolls or plates each having an axial direction in the width direction of said film are arranged in parallel in the moving direction of said film; wherein vertically movable guide means for independently moving said rolls or plates in the width direction of said film is provided; wherein each roll or plate is slidably movable on said film from one end to the other; and
25 wherein said rolls or plates are repeatedly subjected to a cycle of moving away from said film after reaching the other end and returning to the original position; and wherein the movement of said rolls or plates is controlled such that at least any one of rolls or plates is always in sliding

contact with said film over its entire width, whereby said linear scratches are formed on said film slantingly to its moving direction.

28. The method for producing an easy-to-straight-tear thermoplastic resin film according to claim 27, wherein said rolls are rotated at a lower

5 peripheral speed than the moving speed of said film in an opposite direction to the moving direction of said film.

29. The method for producing an easy-to-straight-tear thermoplastic resin film according to any one of claims 10 to 21, wherein at least two roll trains each comprising small rolls having a large number of fine hard

10 particles on the surface, which are mounted to supports in parallel, are arranged in the width direction of said film, said roll trains independently moving along vertically movable guide means in the width direction of said film; wherein each roll train slidably moves on said film from one end to the other, and is repeatedly subjected to a cycle of moving away from said 15 film after reaching the other end and returning to the original position, during which the movement of said roll trains is controlled such that at least any one of said roll trains is always in sliding contact with said film over its entire width, whereby said linear scratches are formed on said film slantingly to its moving direction.

20 30. The method for producing an easy-to-straight-tear thermoplastic resin film according to claim 29, wherein the axial direction of each small roll in said roll trains is substantially in alignment with the longitudinal direction of said film.

31. The method for producing an easy-to-straight-tear thermoplastic resin film according to any one of claims 10 to 21, wherein an endless 25 pattern belt comprising small rolls or plates having a large number of fine hard particles on the surfaces in parallel, which are longer than the width of the film, is arranged slantingly to its moving direction such that each small

roll or plate can be in sliding contact with said film on said film; and wherein said endless pattern belt is rotated in an upstream direction of said film to continuously bring said small rolls or plates into sliding contact with said film, whereby said linear scratches are formed on said film

5 substantially in its width direction.

32. The method for producing an easy-to-straight-tear thermoplastic resin film according to claim 31, wherein said film-pressing means is an endless brush comprising a large number of hairs on an endless belt, which is longer than the width of the film; wherein said endless brush is arranged 10 in parallel with said endless pattern belt via said film; and wherein said endless brush is rotated such that the direction of said hairs slidably moving on said film is opposite to the direction of said small rolls or plates slidably moving on said film, thereby continuously bringing said hairs into sliding contact with said film.

15 33. The method for producing an easy-to-straight-tear thermoplastic resin film according to any one of claims 10 to 21, wherein at least two rolls each having an axial direction slanting to the moving direction of said film and vertically movable guide means for independently moving said rolls are arranged; wherein each roll slidably moves on said film from one 20 end to the other, and is repeatedly subjected to a cycle of moving away from said film after reaching the other end and returning to the original position, during which the movement of said rolls is controlled such that at least any one of said rolls is always in sliding contact with said film over its entire width, whereby said linear scratches are formed on said film 25 substantially in its width direction.

34. The method for producing an easy-to-straight-tear thermoplastic resin film according to claim 33, wherein each roll is rotated at a lower peripheral speed than the moving speed of said film in an opposite

direction to the moving direction of said film.

35. The method for producing an easy-to-straight-tear thermoplastic resin film according to any one of claims 10 to 21, wherein at least two roll trains each comprising small rolls having a large number of fine hard particles on the surfaces, which are mounted to supports in parallel, are arranged on said film slantingly to its moving direction; wherein vertically movable guide means for independently moving said roll trains in the width direction of said film are arranged; wherein each roll train slidably moves on said film from one end to the other, and is repeatedly subjected to a cycle of moving away from said film after reaching the other end and returning to the original position, during which the movement of said roll trains is controlled such that at least any one of said roll trains is always in sliding contact with said film over its entire width, whereby said linear scratches are formed on said film substantially in its width direction.

15 36. An apparatus comprising (a) a means for moving a thermoplastic resin film, (b) a linear-scratch-forming means having a lot of fine projections, which is brought into sliding contact with said film to form substantially parallel linear scratches, and (c) a means for pressing said film from the opposite side of said linear-scratch-forming means in a region in which said film is in sliding contact with said linear-scratch-forming means.

20 37. The apparatus for producing an easy-to-straight-tear thermoplastic resin film according to claim 36, wherein said linear-scratch-forming means is a roll or a plate comprising a lot of fine hard particles on its surface.

25 38. The apparatus for producing an easy-to-straight-tear thermoplastic resin film according to claim 37, wherein said fine particles have a Mohs' hardness of 5 or more.

39. The apparatus for producing an easy-to-straight-tear thermoplastic resin film according to claim 38, wherein said fine particles are fine diamond particles.

40. The apparatus for producing an easy-to-straight-tear thermoplastic resin film according to any one of claims 36 to 39, wherein said film-pressing means is an air-blowing means.

41. The apparatus for producing an easy-to-straight-tear thermoplastic resin film according to claim 40, wherein the pressure of an airflow blown onto said film is 0.05 to 5 kgf/cm².

42. The apparatus for producing an easy-to-straight-tear thermoplastic resin film according to claim 40 or 41, wherein said air-blowing means is a blower or a nozzle.

43. The apparatus for producing an easy-to-straight-tear thermoplastic resin film according to any one of claims 36 to 39, wherein said film-pressing means is a brush brought into sliding contact with said film.

44. The apparatus for producing an easy-to-straight-tear thermoplastic resin film according to claim 43, wherein said brush has hairs having a recovery-from-bending ratio of 70% or more, a diameter of 0.1 to 1.8 mm and a length of 1 to 8cm, and a density of 100 to 500/cm² on the brush-sliding surface.

45. The apparatus for producing an easy-to-straight-tear thermoplastic resin film according to claim 43 or 44, wherein said brush is in sliding contact with said film at a pressure of 0.01 to 5 kg/cm² on said brush-sliding surface.

46. The apparatus for producing an easy-to-straight-tear thermoplastic resin film according to any one of claims 37 to 45, wherein said roll has an outer diameter of 2 to 20 cm.

47. The apparatus for producing an easy-to-straight-tear thermoplastic

resin film according to any one of claims 36 to 46, comprising a means for applying a tension of 0.01 to 5 kgf/cm width to said film in sliding contact with said linear-scratch-forming means.

48. The apparatus for producing an easy-to-straight-tear thermoplastic

5 resin film according to any one of claims 36 to 47, wherein the moving speed of said film is 10 to 500 m/minute.

49. The apparatus for producing an easy-to-straight-tear thermoplastic resin film according to any one of claims 37 to 48, wherein linear scratches are formed in the moving direction of said film with the position of said

10 rolls or plates fixed in the width direction of said film.

50. The apparatus for producing an easy-to-straight-tear thermoplastic

resin film according to claim 49, wherein the rotation axis of said roll is

parallel with the width direction of said film; and wherein said roll is

rotated at a lower peripheral speed than the moving speed of the film in an

15 opposite direction to the moving direction of the film.

51. The apparatus for producing an easy-to-straight-tear thermoplastic

resin film according to claim 50, wherein the peripheral speed of said roll is

1 to 50 m/minute.

52. The apparatus for producing an easy-to-straight-tear thermoplastic

20 resin film according to any one of claims 37 to 48, wherein said

linear-scratch-forming means is an endless pattern belt comprising small

rolls or plates having a large number of fine hard particles on the surfaces

in parallel, which are longer than the width of the film; wherein each small

roll or plate is arranged in the width direction of said film such that it is in

25 sliding contact with said film; and wherein said endless pattern belt is

rotated so that said small rolls or plates are continuously brought into

sliding contact with said film, whereby said linear scratches are formed on

said film slantly to its moving direction.

53. The apparatus for producing an easy-to-straight-tear thermoplastic resin film according to claim 52, wherein said film-pressing means is an endless brush comprising a large number of hairs on an endless belt, which is longer than the width of the film; wherein said endless brush is arranged

5 in parallel with said endless pattern belt via said film; and wherein said endless brush is rotated such that the direction of said hairs slidably moving on said film is opposite to the direction of said small rolls or plates slidably moving on said film, whereby said hairs are continuously in sliding contact with said film.

10 54. The apparatus for producing an easy-to-straight-tear thermoplastic resin film according to any one of claims 37 to 48, comprising at least two rolls or plates each having an axial direction in the width direction of said film, which are arranged in parallel with the moving direction of said film; and vertically movable guide means for independently moving said rolls or

15 plates in the width direction of said film; wherein each roll or plate slidably moves on said film from one end to the other, and is repeatedly subjected to a cycle of moving away from said film after reaching the other end and returning to the original position, during which the movement of said rolls or plates is controlled such that at least any one of rolls or plates is always

20 in sliding contact with said film over its entire width, whereby said linear scratches are formed on said film slantingly to its moving direction.

55. The apparatus for producing an easy-to-straight-tear thermoplastic resin film according to claim 54, wherein said rolls are rotated at a lower peripheral speed than the moving speed of said film in an opposite

25 direction to the moving direction of said film.

56. The apparatus for producing an easy-to-straight-tear thermoplastic resin film according to any one of claims 37 to 48, comprising at least two roll trains in the width direction of said film, each of which comprises

small rolls having a large number of fine hard particles on the surfaces and mounted to supports in parallel; and vertically movable guide means for independently moving said roll trains in the width direction of said film; wherein each roll train slidably moves on said film from one end to the 5 other, and is repeatedly subjected to a cycle of moving away from said film after reaching the other end and returning to the original position, during which the movement of said roll train is controlled such that at least any one of said roll trains is always in sliding contact with said film over its entire width, whereby said linear scratches are formed on said film 10 slantingly to its moving direction .

57. The apparatus for producing an easy-to-straight-tear thermoplastic resin film according to claim 56, wherein the axial direction of each small roll in said roll train is substantially in alignment with the longitudinal direction of said film.

15 58. The apparatus for producing an easy-to-straight-tear thermoplastic resin film according to any one of claims 37 to 48, wherein said linear-scratch-forming means is an endless pattern belt comprising small rolls or plates having a large number of fine hard particles on the surface in parallel, which are longer than the width of the film; wherein each small 20 roll or plate is arranged slantingly to the moving direction of said film such that it can be in sliding contact with said film; and wherein said endless pattern belt is rotated in an upstream direction of said film such that said small rolls or plates are continuously in sliding contact with said film, whereby said linear scratches are formed on said film substantially in its 25 width direction.

59. The apparatus for producing an easy-to-straight-tear thermoplastic resin film according to claim 58, wherein said film-pressing means is an endless brush comprising a large number of hairs on an endless belt, which

is longer than the width of the film; wherein said endless brush is arranged in parallel with said endless pattern belt via said film; and wherein said endless brush is rotated such that the direction of said hairs slidably moving on said film is opposite to the direction of said small rolls or plates slidably moving on said film, whereby said hairs are continuously in sliding contact with said film.

60. The apparatus for producing an easy-to-straight-tear thermoplastic resin film according to any one of claims 37 to 48, comprising at least two rolls each having an axial direction slanting to the moving direction of said film, vertically movable guide means for independently moving said rolls, and a mechanism for controlling said support member, wherein each roll slidably moves on said film from one end to the other, and is repeatedly subjected to a cycle of moving away from said film after reaching the other end and returning to the original position, during which the movement of said roll is controlled such that at least any one of said rolls is always in sliding contact with said film over its entire width, whereby said linear scratches are formed on said film substantially in its width direction.

61. The apparatus for producing an easy-to-straight-tear thermoplastic resin film according to claim 60, wherein each roll is rotated at a lower peripheral speed than the moving speed of said film in an opposite direction to the moving direction of said film.

62. The apparatus for producing an easy-to-straight-tear thermoplastic resin film according to any one of claims 37 to 48, wherein said linear-scratch-forming means is at least two roll trains each comprising small rolls having a large number of fine hard particles on the surfaces, which are mounted to supports in parallel; wherein said roll trains are arranged slantingly to the moving direction of said film; wherein said apparatus comprises vertically movable guide means for independently

moving said roll trains in the width direction of said film; and wherein each roll train slidably moves on said film from one end to the other, and is repeatedly subjected to a cycle of moving away from said film after reaching the other end and returning to the original position, during which

- 5 the movement of said roll trains is controlled such that at least any one of said roll trains is always in sliding contact with said film over its entire width, whereby said linear scratches are formed on said film substantially in its width direction.